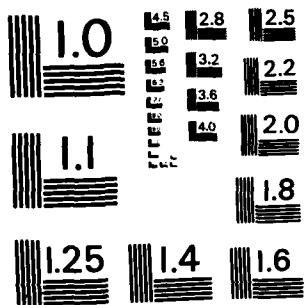


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FLEET MOORING LEG
DESIGN PROGRAM DOCUMENTATION

Volume 5

SOURCE LISTINGS:
COMPOUND LEG BASIC SOLUTION

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IV. SOURCE LISTINGS

COMPOUND LEG BASIC SOLUTION

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```

      et sys final/!2for/cslack for##
      subroutine CSACK
*****
      implicit integer*2 (n)
      integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,inbrnch,uz(5)
      double precision z(67),cz,cx,d,ta,tb
      common /VGL0B/ ileg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
      & isol,inbrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,a1a,v1a,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
      & x1a,y1a,x2a,x3a,y1a,y2a,y3a,
      & tana2a,tana3a,tana4a,tana5a,tana6a,la,phia
      equivalence (za(1),ha),(za(2),a1a,va),
      & (za(3),s1a),(za(4),w1a),(za(5),c1a),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
      & (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phia)
      double precision hb,a1b,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tana2b,tana3b,tana4b,tana5b,tana6b,lb,phib
      equivalence (zb(1),hb),(zb(2),a1b,vb),
      & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
      & (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib)
      double precision col1,slp,frct,c3,s4,w4,x4,y4,tana7,tana8,l,
      & h,phih,rtot,xtot,ztot,do
      equivalence (z(51),col1),(z(52),slp),(z(53),frct),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tana7),(z(60),tana8),(z(61),l),
      & (z(62),h),(z(63),phih),
      & (z(64),rtot),(z(65),xtot),(z(66),ztot),(z(67),do)
      integer*2 iuks
      equivalence (uz(3),iuks)

```

```

double precision pi,halfpi,degrad,raddeg,zero,one,half
integer*2 izero,ione,ittwo
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,ittwo

integer*2 iscoba,iscobp,itana,itanb,ii,is
double precision epsy,gamma,se
common /VCMPPD/ epsy,gamma,se,iscoba,iscobp,itana,itanb,ii,is

integer*2 itold
double precision ss0,dien0,ss1,dien1,ss2,dien2,sip0,s00,smin(2)
common /VEQUAL/ ss0,dien0,ss1,dien1,ss2,dien2,sip0,s00,smin,
& itold
equivalence (smin(1),samin),(smin(2),sbmin)

double precision sa,sb,ca,cb,vc0a(6),vc0b(6),
& eex0,eey0,eey0,a0,b0,phi0,phi0,phi0
integer*2 icase
common /VSPID/ sa,sb,ca,cb,vc0a,vc0b,
& eex0,eey0,eey0,a0,b0,phi0,phi0,phi0,
& icase

double precision snphih,csphih,snafh,csafh,inafh,scafh,dsnph
common /VHDIR/ snphih,csphih,snafh,csafh,inafh,scafh,dsnph

double precision hinafh,hw4,w4h,s4w4h,c3h
common /VHEC/ hinafh,hw4,w4h,s4w4h,c3h

double precision epsxz,xztru(2),xzbos(2),hbos(2),scrat1(10)
common /VCSSXZ/ epsxz,xztru,xzbos,hbos,scrat1
double precision xtru,ztru,xbos,zbos,hbosx,hbosz
equivalence (xztru(1),xtru),(xztru(2),ztru),
& (xzbos(1),xbos),(xzbos(2),zbos),
& (hbos(1),hbosx),(hbos(2),hbosz)

integer*2 itant
double precision a,b,snphih,inafh,inafb,
& seco7,seco8,ut,st,ykt,zkt,eex,eey,ybuoy
common /VCSSH/ a,b,snphih,inafh,inafb,
& seco7,seco8,ut,st,ykt,zkt,eex,eey,ybuoy,itant

integer*2 itvs
double precision v0,v1,v2,f0,f1,f2,f,eps

```

```
common /VSEC/ v0,v1,v2,f0,f1,f2,f,eps,ivs
double precision varray(3),farray(3)
equivalence (v0,varray),(f0,farray)

integer*2 lh0,lh1,lh2,i
double precision lh0,lh1,lh2,ce
common /VSOCIL/ lh0,lh1,lh2,ce,lh0,lh1,lh2,i
integer*2 lh(3)
double precision lh(3)
equivalence (lh,lh0),(lh,lh0)

double precision xred
integer*2 isidr,nerrr,nerrb
common /VSTAB/ xred,isidr,nerrr,nerrb
*****
* BEGIN EXECUTABLE CODE
*****call ovlink('CPREP0 ')
if (ileg eq 3) call CPREP1
goto 11000,2000,3000), iuks

1000 continue
call CPREP2
call CPREP3
if (ileg ne 3) goto 1200
call ovlink('CSSHP ')
goto 1500
1200 continue
call ovlink('CSEHP ',0)
1500 continue
goto 5000

2000 continue
call CPREP2
if (ileg ne 3) goto 2200
call ovlink('CSSPR ',0)
goto 2500
2200 continue
call ovlink('CSEPR ',0)
2500 continue
goto 5000

3000 continue
```

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```
if ((leg ne 3) goto 3200
call ovlink('CSSXZ1 ')
call ovlink('CSSXZ2 ')
goto 3500
3200 continue
call ovlink('CSEXZ1 ')
call ovlink('CSEXZ2 ')
3500 continue
5000 continue
return
end
*
```

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```

      ei sys final/:2for/cprep0 for##
      subroutine CPREP0
***** implicit integer*2 (#)
***** implicit double precision (a-z)
      integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,ta,tb
      common /VCL0B/:leg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
& isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,ala,va,sla,wla,c1a,s2a,w2a,c2a,s3a,w3a,
& xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
& tana2a,tana3a,tana4a,tana5a,tana6a,la,phia
      equivalence (za(1),ha),(za(2),ala,va),
      & (za(3),sla),(za(4),wla),(za(5),c1a),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
      & (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phia)
      double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tana2b,tana3b,tana4b,tana5b,tana6b,lb,phib
      equivalence (zb(1),hb),(zb(2),alb,vb),
      & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
      & (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib)
      double precision co11,s1p1,frc1,c3,s4,w4,x4,y4,tana7,tana8,l,
& h,phih,r1ot,x1ot,z1ot,do
      equivalence (z(51),co11),(z(52),s1p1),(z(53),frc1),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tana7),(z(60),tana8),(z(61),l),
& (z(62),h),(z(63),phih),
& (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)
      integer*2 nc(2)
      equivalence (nca,nc)

```

```

integer*2 uz1,uz2
 equivalence (uz(1),uz1),(uz(2),uz2)

double precision pi,halfpi,degrad,raddeg,zero,one,half
integer*2 izero,ione,itwo
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,itwo

double precision delyk,twod,halfd,dsg
common /VANCH/ delyk,twod,halfd,dsg

integer*2 iscoba,iscopb,itanb,itanb,il,is
double precision epsy,gamma,se
common /VCMPD/ epsy,gamma,se,iscoba,iscopb,itanb,itanb,il,is

integer*2 itold
double precision ss0,dten0,ss1,dten1,ss2,dten2,sip0,s00,smin(2)
common /VEQUAL/ ss0,dten0,ss1,dten1,ss2,dten2,sip0,s00,smin,
& itold
 equivalence (smin(1),samin),(smin(2),sbmin)

integer*2 i1,i,j,n
*****  

i1=2*nca+17
i1=2*ncb+17
iscoba=3*nca
iscopb=3*ncb+25
se=z(iscoba)+z(iscopb)

yk=cz*halfd
do 20 i1=1,2
smn=(do-yk)-s4
n=ncl(i1)
do 10 i=1,n
if (i .eq. 1) goto 10
j=25*(i1-1)+3*(i-1)
smn=smn-z(j)
10 continue
smn(i1)=dmax1(smn,zero)
yk=-yk
20 continue

sip0=dmax1(dmin1(sip,z(iscoba)-samin),sbmin-z(iscopb))

```

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```
saθ-z(i scopal)
return
end
```

*

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```

      er sys final/r2for/cprepi for#
      subroutine CPREP1
***** implicit double precision (a-z)
      integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,tg,rb
      common /VGL0B/ ileg,ist,nca,ncb,z,cz,cx,d,tg,rb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,al0,va,s1a,w1a,cl0,s2a,w2a,c2a,s3a,w3a,
      & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
      & tan02a,tan03a,tan04a,tan05a,tan06a,la,phi0
      equivalence (za(1),ha),(za(2),al0,va),
      & (za(3),s1a),(za(4),w1a),(za(5),cl0),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tan02a),(za(20),tan03a),(za(21),tan04a),
      & (za(22),tan05a),(za(23),tan06a),(za(24),la),(za(25),phi0)
      double precision hb,alb,vb,slb,w1b,clb,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tan02b,tan03b,tan04b,tan05b,tan06b,lb,phi0b
      equivalence (zb(1),hb),(zb(2),alb,vb),
      & (zb(3),slb),(zb(4),w1b),(zb(5),clb),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tan02b),(zb(20),tan03b),(zb(21),tan04b),
      & (zb(22),tan05b),(zb(23),tan06b),(zb(24),lb),(zb(25),phi0b)
      double precision coil,slp,frc1,c3,s4,w4,x4,y4,tan07,tan08,l,
      & h,phi0h,r1ot,z1ot,do
      equivalence (z(51),coil),(z(52),slp),(z(53),frc1),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tan07),(z(60),tan08),(z(61),l),
      & (z(62),h),(z(63),phi0h),
      & (z(64),r1ot),(z(65),z1ot),(z(66),z1ot),(z(67),do)

      double precision pi,halfpi,degrad,raddeg,zero,one,half
      integer*2 izero,ione,iwo

```

```

common /VCONST/ pi, halfpi, degrad, raddeg, zero, one, half,
& izero, ione, itwo

double precision delyk, twod, halfd, dsq
common /VANCH/ delyk, twod, halfd, dsq

double precision sa, sb, ca, cb, vc0a(6), vc0b(6),
& eex0, eez0, eey0, a0, b0, phi0a, phi0b
integer*2 icode
common /VSPID/ sa, sb, ca, cb, vc0a, vc0b,
& eex0, eez0, eey0, a0, b0, phi0a, phi0b,
& icode

equivalence (czsq1, eez0), (ddsq, e1a, eex0), (dasq, eey0),
& (aambb, eex0sq, b0sq, phi0b), (a0sq, phi0a)
*****call SUMSC(nca, za, sa, ca)
call SUMSC(ncb, zb, sb, cb)
call VCRIT0(nca, za, vc0a)
call VCRIT0(ncb, zb, vc0b)
czsq1=cz*cz+one
ddsq=dsq*czsq1
icode=1
if ((sa-sb)**2 gt ddsq) goto 100
icode=2
dasq=sat*sa
aambb=dasq-sb*sb
e1a=dsqr((4.0d0*dasq*ddsq-(ddsq+aambb)**2)/(cx*cx+czsq1))
eez0= -(aambb+cz*cx*e1a)/(twod*czsq1)
eex0=e1a/twod
eey0=cx*eez0+cz*eez0
eex0sq=eex0*eeex0
a0sq=eex0sq+(eez0-hal*fd)**2
b0sq=eex0sq+(eez0+hal*fd)**2
a0=dsqr((a0sq)
b0=dsqr((b0sq)
call PHIB1(a0, b0, a0sq-b0sq, dsq, twod, phi0a, phi0b)
100 continue
return
end
*

```

```
ei sys final/i2for/sumsc for##  
subroutine SUMSC(nc,z,s,c)  
*****  
implicit double precision (a-z)  
  
integer*2 nc  
double precision z(25),s,c  
*****  
s=z(3)  
c=s*z(4)  
if (nc eq 1) goto 100  
s=s+z(6)  
c=c+z(5)+z(6)*z(7)  
if (nc eq 2) goto 100  
s=s+z(9)  
c=c+z(8)+z(9)*z(10)  
100 continue  
return  
end  
*
```

```

      et sys final/12for/cprep2 for##
      subroutine CPREP2
***** implicit double precision (a-z)
      integer#2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,ta,tb
      common /VGLOB/ ileg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,ala,va,sla,wla,cla,s2a,w2a,c2a,s3a,w3a,
      & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
      & tan2a,tan3a,tan4a,tan5a,tan6a,la,phi
      equivalence (za(1),ha),(za(2),ala,va),
      (za(3),sla),(za(4),wla),(za(5),cla),
      (za(6),s2a),(za(7),w2a),(za(8),c2a),
      (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      (za(13),x1a),(za(14),x2a),(za(15),x3a),
      (za(16),y1a),(za(17),y2a),(za(18),y3a),
      (za(19),tan2a),(za(20),tan3a),(za(21),tan4a),
      (za(22),tan5a),(za(23),tan6a),(za(24),la),(za(25),phi)
      double precision hb,alb,vb,s1b,w1b,clb,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tan2b,tan3b,tan4b,tan5b,tan6b,lb,phib
      equivalence (zb(1),hb),(zb(2),alb,vb),
      (zb(3),s1b),(zb(4),w1b),(zb(5),clb),
      (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      (zb(19),tan2b),(zb(20),tan3b),(zb(21),tan4b),
      (zb(22),tan5b),(zb(23),tan6b),(zb(24),lb),(zb(25),phib)
      double precision co11,s1p,frct,c3,s4,w4,x4,y4,tan7,tan8,l,
      & phib,r1ot,x1ot,z1ot,do
      equivalence (z(51),co11),(z(52),s1p),(z(53),frct),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tan7),(z(60),tan8),(z(61),l),
      & (z(62),h),(z(63),phib),
      & (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)

      double precision pi,halfpi,degrad,radddeg,zero,one,half
      integer#2 izero,ione,itwo

```

```
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,  
& 1zero,1one,1two  
double precision inaf,phi,f  
common /VOFLR/ inaf,phi,f  
  
double precision snphih,csphih,snafh,csafh,inafh,scafh,dspnh  
common /VHDIR/ snphih,csphih,snafh,csafh,inafh,scafh,dspnh  
*****  
csphih=dcos(phi,h)  
snphih=dsin(phi,h)  
inafh=dcos(phi,h-phi,f)*inaf  
scafh=SECNT(inafh)  
snafh=inafh/scafh  
csafh=one/scafh  
dspnh=d*snphih  
return  
end  
*
```

```

at sys final/r2for/cprep3 for#
subroutine CPREP3
*****
implicit double precision (a-z)

integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
double precision z(67),cz,cx,d,ta,ib
common /VGL0B/ ileg,ist,nca,ncb,z,cz,cx,d,ta,ib,nwa,nwb,
& isol,ibrnch,uz
double precision za(25),zb(25)
equivalence (z(1),za(1)),(z(26),zb(1))
double precision ha,ala,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
& x0,y0,x1a,x2a,x3a,y1a,y2a,y3a,
& tana2a,tana3a,tana4a,tana5a,tana6a,la,phi,a
equivalence (za(1),ha),(za(2),ala,va),
& (za(3),s1a),(za(4),w1a),(za(5),c1a),
& (za(6),s2a),(za(7),w2a),(za(8),c2a),
& (za(9),s3a),(za(10),w3a),(za(11),x0),(za(12),y0),
& (za(13),x1a),(za(14),x2a),(za(15),x3a),
& (za(16),y1a),(za(17),y2a),(za(18),y3a),
& (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
& (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phi,a)
double precision hb,a1b,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tana2b,tana3b,tana4b,tana5b,tana6b,lb,phi,b
equivalence (zb(1),hb),(zb(2),a1b,vb),
& (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
& (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
& (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
& (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phi,b)
double precision co1,slp,frc1,c3,s4,w4,x4,y4,tan67,tan68,l,
& h,phi,h,r1ot,x1ot,z1ot,do
equivalence (z(51),co1),(z(52),slp),(z(53),frc1),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tan67),(z(60),tan68),(z(61),l),
& (z(62),h),(z(63),phi,h),
& (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)

double precision snphih,csphih,snphf,csphf,tanphf,scaphf
common /VHDIR/ snphih,csphih,snphf,csphf,tanphf,scaphf

```

```
double precision h1nafh,hw4,w4h,s4w4h,c3h
common /VHVEC/ h1nafh,hw4,w4h,s4w4h,c3h
*****
h1nafh=h1nafh
hw4=h/w4
w4h=w4/h
s4w4h=s4*w4h
c3h=c3/h
return
end
*
```

```

et sys final/t2for/csshp fort
subroutine CSSHP
***** implicit integer*2 (#)
***** implicit double precision (a-z)

integer*2 ilag,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
double precision z(67),cz,cx,d,tg,lb
common /VGLOB/ ilag,ist,nca,ncb,z,cz,cx,d,tg,lb,nwa,nwb,
& isol,ibrnch,uz
double precision za(25),zb(25)
equivalence (z(1),za(1)),(z(26),zb(1))
double precision ha,alb,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
& xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
& tan2a,tan3a,tan4a,tan5a,tan6a,la,phi,a
equivalence (za(1),ha),(za(21),alb,va),
& (za(31),s1a),(za(4),w1a),(za(5),c1a),
& (za(6),s2a),(za(7),w2a),(za(8),c2a),
& (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
& (za(13),x1a),(za(14),x2a),(za(15),x3a),
& (za(16),y1a),(za(17),y2a),(za(18),y3a),
& (za(19),tan2a),(za(20),tan3a),(za(21),tan4a),
& (za(22),tan5a),(za(23),tan6a),(za(24),la),(za(25),phi,a)
double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tan2b,tan3b,tan4b,tan5b,tan6b,lb,phi,b
equivalence (zb(1),hb),(zb(21),alb,vb),
& (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
& (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
& (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tan2b),(zb(20),tan3b),(zb(21),tan4b),
& (zb(22),tan5b),(zb(23),tan6b),(zb(24),lb),(zb(25),phi,b)
double precision co1,slp,frc1,c3,s4,w4,x4,y4,tan67,tan68,l,
& h,phi,h,rtot,xtot,ztot,do
equivalence (z(51),co1),(z(52),slp),(z(53),frc1),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tan67),(z(60),tan68),(z(61),l),
& (z(62),h),(z(63),phi,h),
& (z(64),rtot),(z(65),xtot),(z(66),ztot),(z(67),do)

double precision pi,halfpi,degrad,raddeg,zero,one,half

```

```

integer*2 izero,ione,ito
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,ito

double precision inaf,phif
common /VOFLR/ inaf,phif

double precision delyk,twod,halfd,dsq
common /VANCH/ delyk,twod,halfd,dsq

integer*2 iscopa,iscopb,ilana,ilanb,ie
double precision epsy,gamma,se
common /VCMPD/ epsy,gamma,se,iscopa,iscopb,ilana,ilanb,ie

double precision sa,sb,ca,cb,vc0a(6),vc0b(6),
& eex0,eez0,eey0,a0,b0,phi0,phi0
integer*2 icase
common /VSP10/ sa,sb,ca,cb,vc0a,vc0b,
& eex0,eez0,eey0,a0,b0,phi0,phi0,
& icase

double precision snphih,csphih,snphf,csphf,inaph,scaph
common /VHDIR/ snphih,csphih,snphf,csphf,inaph,scaph

double precision hinaph,hw4,w4h,s4w4h,c3h
common /VHVEC/ hinaph,hw4,w4h,s4w4h,c3h

integer*2 itan1
double precision a,b,snphi,inaph,inafb,
& sec07,sec08,ut,st,ykt,zkt,eex,eez,eey,ybuoy
common /VCSSHP/ a,b,snphi,inaph,inafb,
& sec07,sec08,ut,st,ykt,zkt,eex,eez,eey,ybuoy,itan1

integer*2 ivs
double precision v0,v1,v2,f0,f1,f2,f,eps
common /VSEC/ v0,v1,v2,f0,f1,f2,f,eps,ivs

double precision xred
integer*2 isidr,nerrr,nerrb
common /VSTAB/ xred,isidr,nerrr,nerrb

integer*2 ieb,nw,intest,nerr
*****
```

```

epsy=do*1 0d-10
ibrnch=1
lrb=0

nw=0
if (nwa eq 0 and nwb eq 0) goto 500
nw=1
if (nwa eq 1 and nwb eq 1) goto 1000
if (nwb eq 1) ibrnch=2
goto 3000

*****  

* Determine the number of branches under tension  

* when junction lies on ocean floor  

*****  

500 continue
*****  

* If branch lengths differ by more than distance between anchors,  

* then one branch is under tension  

*****  

if (lcase eq 1) goto 2000
*****  

* If load is directed outside angle formed by branch extensions,  

* then one branch is under tension  

*****  

if (phih lt phia0 or phih gt phib0) goto 2000

*****  

* Both branches are under tension if junction lies on ocean floor  

* Assume this to be the case, with branches forming a triangle  

* Calculate buoy elevation when junction is just lifted off floor  

*****  

phia=phia0
phib=phib0
call HSPLIT
tang7=(c3+h*a*inafa+hb*inafb)/h
call TRISR
ybuoy=eey0+y4
if (ybuoy lt do) goto 1200
*****  

* Computed buoy elevation is no less than water level,  

* therefore junction lies on ocean floor  

* Calculate riser displacements and angles directly

```

```

*****
call SRISR(eey0,one)
call TSPLIT
call JUNCT(lnaf0,lnafb,0)
eex-eex0
eez-eez0
isol=1
goto 5000
*****
* Computed buoy elevation is less than water level,
* therefore junction lies above ocean floor
* Test each branch for plane solution before searching for solution
* in three dimensions, shorter branch is first to be tested
*****
1200 continue
if (sa gt sb) ibranch=2
goto 3000
*****
* One branch is under tension if junction lies on ocean floor
* This is true for one or two reasons, as indicated by index 'icase'
* 1 if branch lengths differ by more than distance between anchors
* 2 if load is directed outside angle formed by branch extensions
* Assume that junction lies on ocean floor
*****
* Determine index 'ibrnch' of branch under tension 1 for A, 2 for B
*****
2000 continue
if (icase ne 11) goto 2010
if (sa gt sb) ibrnch=2
goto 2015
2010 continue
if (phih gt phib) ibrnch=2
2015 continue
*****
* Set parameters for branch under tension
* Calculate buoy elevation when junction is just lifted off ocean floor
*****
call EBUOY
if (ybuoy lt do) goto 2200
*****
* Computed buoy elevation is no less than water level,
* therefore junction lies on ocean floor

```

```

* Calculate riser displacements and angles directly
*****  

call SRISR(eey,one)
call JTEN(ta)
rb-zero
if (ibrnch eq 1) goto 2110
rb-ta
ta-zero
2110 continue
gamma-pi
eex-si*csafh
eez-zk1+eex*snphih
eex-eex*csphih
isol-2
goto 5000
*****  

* Computed buoy elevation is less than water level,
* therefore junction lies above ocean floor
* Test each branch for plane solution before searching for solution
* in three dimensions, beginning with branch currently assumed to be
* under tension
*****  

2200 continue
tcb-1
*****  

* Possibility of junction on floor has been eliminated
* For each branch, find solution in vertical plane of loading force,
* and compute straight-line distances for other branch
*****  

3000 continue
ntest-1
3010 continue
if (tcb eq 1) goto 3100
call EBUOY
if (nw eq 0 and ybuoy gt dol) goto 3500
3100 continue
if (ibrnch eq 2) goto 3150
call SC0IL(nca,za,vc0a,ca,nwa,ncb,zb,vc0b,sb,nerr)
goto 3200
3150 continue
call SC0IL(ncb,zb,vc0b,cb,nwb,nca,za,vc0a,sa,nerr)
3200 continue

```

```

    if (inerr eq 0 and coil ge zero) goto 3600
*****
* No possibility of plane solution in current tension branch
* Either depth is insufficient (from subroutine EBOUY,
* or other branch is too short (from subroutine SCOIL)
*****
3500 continue
    if (nrest eq 2 or nw eq 1) goto 1000
    ibrnch=3-ibrnch
    nrest=2
    ieb=0
    goto 3010
*****
* Solution in plane of loading force is consistent with length of
* other branch
*****
3600 continue
    isol=3
    goto 5000
*****
* Solution must be three-dimensional with junction above ocean floor,
* solve by iteration over sides a,b of horizontal triangle
*****
4000 continue
    call STEFAB
    call JUNCT(zsol1,anb),zbl1,anb),1)
    eex=x0*dcos(phi0)
    eez=halfd+x0*dsin(phi0)
    isol=4
    ****
    * Final computations for all solution types
    ****
5000 continue
    gamma=dexp(gamma*frc1)
    x101=eex+x1*csph1h
    z101=eez+x1*sph1h
    r101=csph1h*x101+sph1h*z101
    return
    end
*

```

110

```
et sys final/12for/phiab for##
subroutine PHIAB(a,b,aambb,dsq,twod,phi_a,phi_b)
*****  
implicit double precision (a-z)
double precision a,b,aambb,dsq,twod,phi_a,phi_b
double precision pi,halfpi,degrad,radddeg,zero,one,half
integer*2 izero,ione,iwo
common /VCONST/ pi,halfpi,degrad,radddeg,zero,one,half,
& izero,ione,iwo
*****  
phi_a=dacos((dsq+aambb)/(a*twod))-halfpi
phi_b=halfpi-dacos((dsq-aambb)/(b*twod))
return
end
*
```

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```

      I
      III

      ET SYS FINAL/I2FOR/HSPPLIT FOR#
      subroutine HSPLIT
*****implicit double precision (a-z)
      integer*2  ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,ta,tb
      common /VGL0B/ ileg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      common /VGL0B/ ileg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
      & isol,ibrnch,uz
      double precision ha,al,a,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
      & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
      & tana2a,tana3a,tana4a,tana5a,tana6a,la,phia
      equivalence (za(1),ha),(za(2),al),(za(3),va),
      & (za(4),s1a),(za(5),w1a),(za(6),c1a),
      & (za(7),s2a),(za(8),w2a),(za(9),c2a),
      & (za(10),s3a),(za(11),w3a),(za(12),c3a),
      & (za(13),xa),(za(14),x2a),(za(15),x3a),
      & (za(16),ya),(za(17),y2a),(za(18),y3a),
      & (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
      & (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phia)
      double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tana2b,tana3b,tana4b,tana5b,tana6b,lb,phib
      equivalence (zb(1),hb),(zb(2),alb,vb),
      & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
      & (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib)
      double precision co1,slp,frct,c3,s4,w4,x4,y4,tan07,tan08,l,
      & h,phih,rrot,xrot,zrot,do
      equivalence (z(51),co1),(z(52),slp),(z(53),frct),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tan07),(z(60),tan08),(z(61),l),
      & (z(62),h),(z(63),phih),
      & (z(64),rrot),(z(65),xrot),(z(66),zrot),(z(67),do)

      double precision inaf,phif
      common /VOFLR/ inaf,phif

```

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```
double precision a,b,snphi,inafa,inafb,
& secphi7,secphi8,ut,st,ykt,zkt,eex,eez,eyy,ybuoy
common /VCSSHP/ a,b,snphi,inafa,inafb,
& secphi7,secphi8,ut,st,ykt,zkt,eex,eez,eyy,ybuoy
*****snphi=dsin(phi_b-phi_a)
ha=h*dsin(phi_b-phi_h)/snphi
hb=h*dsin(phi_h-phi_a)/snphi
inafa=dcos(phi_a-phi_f)*inaf
inafb=dcos(phi_b-phi_f)*inaf
return
end
*
```

112

```

et sys final/i2for/inisr for#
 subroutine TRISR
 *****
 implicit double precision (a-z)

 integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
 double precision z(67),cz,cx,d,ta,tb
 common /VGLOB/ ileg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
 & isol,ibrnch,uz
 double precision za(25),zb(25)
 equivalence (z(1),za(1)),(z(26),zb(1))
 double precision ha,al,a,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
 & x1a,y1a,x2a,y2a,x3a,y3a,
 & tan2a,tan3a,tan4a,tan5a,tan6a,la,phi1a
 equivalence (za(1),ha),(za(2),al,a,va),
 & (za(3),s1a),(za(4),w1a),(za(5),c1a),
 & (za(6),s2a),(za(7),w2a),(za(8),c2a),
 & (za(9),s3a),(za(10),w3a),(za(11),x1a),(za(12),y1a),
 & (za(13),x1a),(za(14),x2a),(za(15),x3a),
 & (za(16),y1a),(za(17),y2a),(za(18),y3a),
 & (za(19),tan2a),(za(20),tan3a),(za(21),tan4a),
 & (za(22),tan5a),(za(23),tan6a),(za(24),la),(za(25),phi1a)
 double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
 & x1b,y1b,x2b,x3b,y2b,y3b,
 & tan2b,tan3b,tan4b,tan5b,tan6b,lb,phi1b
 equivalence (zb(1),hb),(zb(2),alb,vb),
 & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
 & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
 & (zb(9),s3b),(zb(10),w3b),(zb(11),x1b),(zb(12),y1b),
 & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
 & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
 & (zb(19),tan2b),(zb(20),tan3b),(zb(21),tan4b),
 & (zb(22),tan5b),(zb(23),tan6b),(zb(24),lb),(zb(25),phi1b)
 double precision co11,s1p,frct1,c3,s4,w4,x4,y4,tan7,tan8,l,
 & h,phi1,r1ot,x1ot,z1ot,do
 equivalence (z(51),co11),(z(52),s1p),(z(53),frct1),(z(54),c3),
 & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
 & (z(59),tan7),(z(60),tan8),(z(61),l),
 & (z(62),h),(z(63),phi1),
 & (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)

 double precision hinash,hw4,w4h,s4w4h,c3h
 common /VHVEC/ hinash,hw4,w4h,s4w4h,c3h

```

```
double precision a,b,snphi,inafa,inafb,
& sec07,sec08,ut,st,ykt,zkt,eex,eez,eyy,ybuoy
common /VCSSHP/ a,b,snphi,inafa,inafb,
& sec07,sec08,ut,st,ykt,zkt,eex,eez,eyy,ybuoy
*****  
tana8=tana7+s4w4h  
call SCA7AB  
y4=hw4*(sec08-sec07)  
return  
end  
*
```

```

et sys final/12for/sec7a8 for**
      subroutine SCA7A8
***** implicit double precision (a-z)
      integer*2  ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(87),cz,cx,d,ta,lb
      common /VCLOB/  ileg,ist,nca,ncb,z,cz,cx,d,ta,lb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,a1a,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
      & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
      & tan2a,tan3a,tan4a,tan5a,tan6a,la,phi_a
      equivalence (za(1),ha),(za(2),a1a,va),
      & (za(3),s1a),(za(4),w1a),(za(5),c1a),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tan2a),(za(20),tan3a),(za(21),tan4a),
      & (za(22),tan5a),(za(23),tan6a),(za(24),la),(za(25),phi_a)
      double precision hb,a1b,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tan2b,tan3b,tan4b,tan5b,tan6b,lb,phi_b
      equivalence (zb(1),hb),(zb(2),a1b,vb),
      & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tan2b),(zb(20),tan3b),(zb(21),tan4b),
      & (zb(22),tan5b),(zb(23),tan6b),(zb(24),lb),(zb(25),phi_b)
      double precision coll,slp,frc1,c3,s4,w4,x4,y4,tan7,tan8,l,
      & h,phi_h,rtot,xtot,ztot,do
      equivalence (z(51),coll),(z(52),slp),(z(53),frc1),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tan7),(z(60),tan8),(z(61),l),
      & (z(62),h),(z(63),phi_h),
      & (z(64),rtot),(z(65),xtot),(z(66),ztot),(z(67),do)
      double precision a,b,snphi,tnafa,tnafb,
      & sec7,sec8,ut,ist,ykt,zkt,eex,eez,eev,ybuoy

```

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```
common /VCSSHP/ a,b,snphi,inofa,inafb,  
& sec07,sec08,ui,si,yk1,zk1,eex,eez,sey,ybuoy  
*****  
sec07=SECNT1(ane7)  
sec08=SECNT1(ane8)  
return  
end  
*
```

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```

e1 sys final/i2for/sr1sr for##
subroutine SR1SR(ey,ifact)
***** implicit double precision (a-z)
      implicit double precision (a-z)

      double precision ey,ifact

      integer*2 ileg,ist1,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,tb,ib
      common /VGL0B/ ileg,ist1,nca,ncb,z,ez,cx,d,tb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,alb,va,s1a,w1a,clb,s2a,w2a,c2a,s3a,w3a,
      & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
      & tana2a,tana3a,tana4a,tana5a,tana6a,la,phia
      equivalence (za(1),ha),(za(2),alb),va),
      & (za(3),s1a),(za(4),w1a),(za(5),clb),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
      & (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phia)
      double precision hb,alb,vb,s1b,w1b,clb,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tana2b,tana3b,tana4b,tana5b,tana6b,lb,phib
      equivalence (zb(1),hb),(zb(2),alb),vb),
      & (zb(3),s1b),(zb(4),w1b),(zb(5),clb),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
      & (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib)
      double precision co11,slp,frct,c3,s4,w4,x4,y4,tana7,tana8,l,
      & h,phih,r1ot,x1ot,z1ot,do
      equivalence (z(51),co11),(z(52),slp),(z(53),frct),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tana7),(z(60),tana8),(z(61),l),
      & (z(62),h),(z(63),phih),
      & (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)

```

```

double precision pi,halfpi,degrad,raddeg,zero,one,half
integer#2 izero,ione,iftwo
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,iftwo

double precision snphih,csphih,sinphih,cosphih,inophi,scaphi
common /VHDIR/ snphih,csphih,sinphih,cosphih,inophi,scaphi

double precision hinophi,hw4,w4h,s4w4h,c3h
common /VHVEC/ hinophi,hw4,w4h,s4w4h,c3h
*****  

y4-do-ey  

l-LENS(y1,csaphi,sinphih,s4,w4h,h)*l fact  

if (l gt zero) goto 20  

l-zero  

tanphi7=TAN1(s4w4h,y4*w4h)  

goto 50  

20 continue  

tanphi7=sinphih  

50 continue  

tanphi8=tanphi7+(s4-1)*w4h  

call SCA7A8  

call X4CALC  

x4=x4+l*csaphi  

return  

end
*
```

```
et sys final/!2for/tanl for#
      function TANL(dt,ds)
*****
* Computes tangent of the algebraically smaller of two angles,
* given the differences between their tangents and secants
*****
      implicit double precision (a-z)

      double precision tanl,dt,ds

      double precision pi,halfpi,degrad,raddeg,zero,one,half
      integer*2 izero,ione,iiwo
      common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
      & izero,ione,iiwo
*****
* tanl - tangent of smaller angle
* dt - tangent of larger angle - tangent of smaller angle
* ds - secant of larger angle - secant of smaller angle
*****
      tanl=half*(ds*dsqrt(one+0d0/(dt*dt-ds*ds))-dt)
      return
      end
*
```

```

      er sys final/r2for/x4calc for##
      subroutine X4CALC
***** implicit double precision (a-z)
      integer#2  ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,ta,lb
      common /VCL0B/  ileg,ist,nca,ncb,z,cz,cx,d,ta,lb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,a1a,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
      & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
      & tanaz0,tanaz3,tanaz4,tanaz5,tanaz6,la,phia
      equivalence (za(1),ha),(za(2),a1a,va),
      & (za(3),s1a),(za(4),w1a),(za(5),c1a),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tanaz2),(za(20),tanaz3),(za(21),tanaz4),
      & (za(22),tanaz5),(za(23),tanaz6),(za(24),la),(za(25),phia)
      double precision hb,a1b,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tanazb,tanaz5b,tanaz4b,tanaz5b,tanaz6b,lb,phib
      equivalence (zb(1),hb),(zb(2),a1b,vb),
      & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tanaz2),(zb(20),tanaz3),(zb(21),tanaz4),
      & (zb(22),tanaz5),(zb(23),tanaz6),(zb(24),lb),(zb(25),phib)
      double precision co1,s1p,frct,c3,s1,w4,x4,y4,tanaz7,tanaz8,l,
      & n,phih,r1o1,x1o1,z1o1,do
      equivalence (z(51),co1),(z(52),s1p),(z(53),frct),(z(54),c3),
      & (z(55),s1),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tanaz7),(z(60),tanaz8),(z(61),l),
      & (z(62),h),(z(63),phih),
      & (z(64),r1o1),(z(65),x1o1),(z(66),z1o1),(z(67),do)

      double precision hinh,hw4,w4h,s4w4h,c3h
      common /VHVEC/  hinh,hw4,w4h,s4w4h,c3h

```

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```
double precision a,b,snphi,tnaf,a,tnafb,  
& sec,a7,sec,a8,ut,st,ykt,zkt,eex,eez,eey,ybuoy  
common /VCSSHP/ a,b,snphi,tnaf,a,tnafb,  
& sec,a7,sec,a8,ut,st,ykt,zkt,eex,eez,eey,ybuoy  
*****  
x1=hw4*dlog((tnaf8+sec,a8)/(tnaf7+sec,a7))  
return  
end  
*
```

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```

      et sys final/12for/1split for##
      subroutine TSPLIT
***** implicit double precision (a-z)
      integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,ta,lb
      common /VCL0B/ ileg,ist,nca,ncb,z,cz,cx,d,ta,lb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1)),za(1),(z(26)),zb(1))
      double precision ha,ala,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
      & x0,y0,x1a,x2a,x3a,y1a,y2a,y3a,
      & rana2a,rana3a,rana4a,rana5a,rana6a,la,phia
      equivalence (za(1)),ha),(za(2)),ala,(va),
      & (za(3)),s1a),(za(4)),w1a),(za(5)),c1a),
      & (za(6)),s2a),(za(7)),w2a),(za(8)),c2a),
      & (za(9)),s3a),(za(10)),w3a),(za(11)),xa),(za(12)),ya),
      & (za(13)),x1a),(za(14)),x2a),(za(15)),x3a),
      & (za(16)),y1a),(za(17)),y2a),(za(18)),y3a),
      & (za(19)),rana2a),(za(20)),rana3a),(za(21)),rana4a),
      & (za(22)),rana5a),(za(23)),rana6a),(za(24)),la),(za(25)),phia)
      double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & rana2b,rana3b,rana4b,rana5b,rana6b,lb,phib
      equivalence (zb(1)),hb),(zb(2)),alb,(vb),
      & (zb(3)),s1b),(zb(4)),w1b),(zb(5)),c1b),
      & (zb(6)),s2b),(zb(7)),w2b),(zb(8)),c2b),
      & (zb(9)),s3b),(zb(10)),w3b),(zb(11)),xb),(zb(12)),yb),
      & (zb(13)),x1b),(zb(14)),x2b),(zb(15)),x3b),
      & (zb(16)),y1b),(zb(17)),y2b),(zb(18)),y3b),
      & (zb(19)),rana2b),(zb(20)),rana3b),(zb(21)),rana4b),
      & (zb(22)),rana5b),(zb(23)),rana6b),(zb(24)),lb),(zb(25)),phib)
      double precision col1,s1p,frct,c3,s4,w4,x4,y4,rana7,rana8,
      & h,phih,r101,x101,z101,do
      equivalence (z(51)),col1),(z(52)),s1p),(z(53)),frct),(z(54)),c3),
      & (z(55)),s4),(z(56)),w4),(z(57)),x4),(z(58)),y4),
      & (z(59)),rana7),(z(60)),rana8),(z(61)),l1,
      & (z(62)),h),(z(63)),phih),
      & (z(64)),r101),(z(65)),x101),(z(66)),z101),(z(67)),do)
      double precision b,sinb,cosb,rancb,secb
      equivalence (z(25)),b),(z(26)),sinb),(z(27)),cosb),(z(28)),rancb),
      & (z(29)),secb)

```

```

integer*2 uz1,uz2,uz3,uz4,uz5
 equivalence (uz(1),uz1),(uz(2),uz2),(uz(3),uz3),(uz(4),uz4),
 & (uz(5),uz5)

 double precision pi,halfpi,degrad,raddeg,zero,one,half
 integer*2 izero,ione,itwo
 common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
 & izero,ione,itwo

 double precision delyk,twod,halfd,dsq
 common /VANCH/ delyk,twod,halfd,dsq

 double precision sa,sb,ca,cb,vc0a(6),vc0b(6),
 & eex0,eez0,eey0,a0,b0,phi0a,phi0b
 integer*2 icase
 common /VSPID/ sa,sb,ca,cb,vc0a,vc0b,
 & eex0,eez0,eey0,a0,b0,phi0a,phi0b,
 & icase

 double precision snphih,cspfh,snafh,csafh,inafh,scafh
 common /VHDIR/ snphih,cspfh,snafh,csafh,inafh,scafh

 equivalence (czsql,ddsq,phibb,eex),(fx,phihh,eez),
 & (fz,dd,snphii,eey),(phiad,gamma)
 ****
 czsql-cz*cz+one
 fx-czsql*cspfh-cx*cz*snphih+cx*inafh
 fz-snphih+cz*inafh
 if (fx ne zero) goto 20
 if (fz lt zero) goto 10
 phihh-halfpi
 goto 15
10 continue
 phihh- -halfpi
15 continue
 goto 50
20 continue
 phihh-de10n(dsqr1(cx*cx+czsql)*fz/fx)
50 continue
 ddsq-dsq*czsql
 dd=dsqr1(ddsq)
 call PHIA8(sa,sb,sa*sa-sb*sb,dd+dd,phiad,phibb)
 snphii-dsin(phibb-phiad)

```

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```
call JTEN(tenj)
ta-tenj*dsin(phibb-phihh)/snphi
tb-tenj*dsin(phihh-phiaa)/snphi
return
end
```

*

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```

et sys final/t2for/jren for##
subroutine JTEN(jren)
*****implicit double precision (a-z)
      implicit double precision (a-z)

      double precision tenj

      integer*2 illeg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,t,a,ib
      common /VCL0B/ illeg,ist,nca,ncb,z,cz,cx,d,t,a,ib,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,a1a,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
      & x0,y0,x1a,x2a,x3a,y1a,y2a,y3a,
      & tan02a,tan03a,tan04a,tan05a,tan06a,la,phia
      equivalence (za(1),ha),(za(2),a1a),va,
      & (za(3),s1a),(za(4),w1a),(za(5),c1a),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),x0),(za(12),y0),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tan02a),(za(20),tan03a),(za(21),tan04a),
      & (za(22),tan05a),(za(23),tan06a),(za(24),la),(za(25),phia)
      double precision hb,a1b,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tan02b,tan03b,tan04b,tan05b,tan06b,lb,phib
      equivalence (zb(1),hb),(zb(2),a1b),vb,
      & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tan02b),(zb(20),tan03b),(zb(21),tan04b),
      & (zb(22),tan05b),(zb(23),tan06b),(zb(24),lb),(zb(25),phib)
      double precision co11,slp,frct,c3,s4,w4,x4,y4,tan07,tan08,la,
      & h,phih,r1ot,x1ot,z1ot,do
      equivalence (z(51),co11),(z(52),slp),(z(53),frct),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tan07),(z(60),tan08),(z(61),la),
      & (z(62),h),(z(63),phih),
      & (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)
      double precision b,sinb,cosb,tanb,secb

```

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```
equivalence (z(25),b),(z(26),sinb),(z(27),cosb),(z(28),tanb),
& (z(29),secb)
integer*2 uz1,uz2,uz3,uz4,uz5
equivalence (uz(1),uz1),(uz(2),uz2),(uz(3),uz3),(uz(4),uz4),
& (uz(5),uz5)
double precision snphih,csphih,snafh,csafh,inafh,scafh
common /VHDIR/ snphih,csphih,snafh,csafh,inafh,scafh
*****  
tanj=h*SECT(tan07)*dcos(datan(tan07)-datan(inafh))
& -(c3+)*w4)*snafh
return
end
*
```

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```

      et sys final/12for/junct for##
      subroutine JUNCT(ina,inb,index)
***** implicit double precision (a-z)
      integer*2 index
      double precision ina,inb
      integer*2 ilag,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(67),cz,cx,d,tg,lb
      common /VGLOB/ ilag,ist,nca,ncb,z,cz,cx,d,tg,lb,nwa,nwb,
      & isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,al0,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
      & x0,y0,x1a,x2a,x3a,y1a,y2a,y3a,
      & tana2a,tana3a,tana4a,tana5a,tana6a,la,phi0
      equivalence (za(1),ha),(za(2),al0,va),
      & (za(3),s1a),(za(4),w1a),(za(5),c1a),
      & (za(6),s2a),(za(7),w2a),(za(8),c2a),
      & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
      & (za(13),x1a),(za(14),x2a),(za(15),x3a),
      & (za(16),y1a),(za(17),y2a),(za(18),y3a),
      & (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
      & (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phi0)
      double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
      & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
      & tana2b,tana3b,tana4b,tana5b,tana6b,lb,phi,b
      equivalence (zb(1),hb),(zb(2),alb,vb),
      & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
      & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
      & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
      & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
      & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
      & (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
      & (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phi,b)
      double precision co1,slp,frct,c3,s4,w4,x4,y4,tan07,tan08,l,
      & h,phi,h,r1o1,x1o1,z1o1,do
      equivalence (z(51),co1),(z(52),slp),(z(53),frct),(z(54),c3),
      & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
      & (z(59),tan07),(z(60),tan08),(z(61),l),
      & (z(62),h),(z(63),phi,h),
      & (z(64),r1o1),(z(65),x1o1),(z(66),z1o1),(z(67),do)

```

```

double precision pi ,halfpi ,degrad ,raddeg ,zero ,one ,half
integer*2 izero ,ione ,itwo
common /VCONST/ pi ,halfpi ,degrad ,raddeg ,zero ,one ,half ,
& izero ,ione ,itwo
integer*2 iscopa ,iscopb ,itana ,itnb ,ie
double precision epsy ,gamma ,se
common /VCMPD/ epsy ,gamma ,se ,iscopa ,iscopb ,itana ,itnb ,ie

double precision a ,b ,snphi ,tnaf ,tnafb ,
& sec ,sec ,ut ,st ,yt ,zt ,eex ,eez ,eey ,ybuoy
common /VCSSHP/ a ,b ,snphi ,tnaf ,tnafb ,
& sec ,sec ,ut ,st ,yt ,zt ,eex ,eez ,eey ,ybuoy

equivalence (csphi ,gamma) ,(sca ,eex) ,(scb ,eez)
*****scfa-SECNT(tna)
scb-SECNT(tnb)
csphi-dsqrt(one-snphi*snphi)
if (phi-bgt halfpi) csphi=-csphi
gamma-pi-dacos((tna*tnb+csphi)/(sca*scb))
if (index ne ione) goto 100
ta-ha*sca
tb-hb*scb
100 continue
return
end
*
```

```

et sys final/r2for/ebuoy for##
  subroutine EBUOY
  ****
  * Assigns values to parameters ut,st,ykt,zkt for branch assumed to be
  * under tension. Assumes junction to be just off ocean floor
  * Computes junction y-coord, vertical riser displacement, buoy y-coord
  *
  * lbrnch = index of tension branch 1 for A, 2 for B
  * ut - unit factor for tension branch 1 for A, -1 for B
  * st - length of tension branch
  * halnb - load on tension branch
  * ykt - y-coord of tension branch anchor
  * zkt - z-coord of tension branch anchor
  * eey - y-coord of junction, in general, of point on floor
  * directly beneath junction
  * ybuoy - y-coord of buoy
  ****
  implicit double precision (a-z)
  integer*2 illeg,ist,nca,ncb,nwa,nwb,isol,lbrnch,uz(5)
  double precision z(67),cz,cx,d,ta,tb
  common /VGLOB/ illeg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
  & isol,lbrnch,uz
  double precision za(25),zb(25)
  equivalence (z(1),za(1)),(z(26),zb(1))
  double precision ha,al,a,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
  & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
  & tan02a,tan03a,tan04a,tan05a,tan06a,la,phi0a
  equivalence (za(3),s1a),(za(4),w1a),(za(5),c1a),
  & (za(6),s2a),(za(7),w2a),(za(8),c2a),
  & (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
  & (za(13),x1a),(za(14),x2a),(za(15),x3a),
  & (za(16),y1a),(za(17),y2a),(za(18),y3a),
  & (za(19),tan02a),(za(20),tan03a),(za(21),tan04a),
  & (za(22),tan05a),(za(23),tan06a),(za(24),la),(za(25),phi0a)
  double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
  & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
  & tan02b,tan03b,tan04b,tan05b,tan06b,lb,phi0b
  equivalence (zb(1),hb),(zb(2),alb,vb),
  & (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
  & (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
  & (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),

```

```

& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
& (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib),
double precision co1,slp,frc1,c3,s4,w4,x4,y4,tana7,tana8,l,
& h,phih,r101,x101,z101,do
 equivalence (z(51),co1),(z(52),slp),(z(53),frc1),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tana7),(z(60),tana8),(z(61),l),
& (z(62),h),(z(63),phih),
& (z(64),r101),(z(65),x101),(z(66),z101),(z(67),do)

double precision pi,halfpi,degrad,raddeg,zero,one,half
integer*2 izero,ione,itwo
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,itwo

double precision delyk,twod,halfd,dsq
common /VANCH/ delyk,twod,halfd,dsq

double precision sa,sb,ca,cb,vc0a(6),vc0b(6),
& eex0,eez0,eey0,a0,b0,phia0,phib0
integer*2 icase
common /VSPID/ sa,sb,ca,cb,vc0a,vc0b,
& eex0,eez0,eey0,a0,b0,phia0,phib0,
& icase

double precision snphih,csphih,snafh,csafh,tanfh,scafh
common /VHDIR/ snphih,csphih,snafh,csafh,tanfh,scafh

double precision hinafh,hw4,w4h,s4w4h,c3h
common /VHVEC/ hinafh,hw4,w4h,s4w4h,c3h

integer*2 iscopa,iscopb,itan,itanb,ie
double precision epsy,gamma,se
common /VCMPD/ epsy,gamma,se,iscopa,iscopb,itan,itanb,ie

integer*2 itant
double precision a,b,snphi,tanfa,tanfb,
& secat,secat8,ut,st,ykt,zkt,eex,eez,eey,ybuoy
common /VCSSHP/ a,b,snphi,tanfa,tanfb,
& secat,secat8,ut,st,ykt,zkt,eex,eez,eey,ybuoy,itan
*****
```

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```
if (ibrnch ne 11 goto 20
ut-one
si-sa
hi-h
l1an1-l1an0
goto 50
20 continue
ut= -one
si-sb
hb-h
l1an1-l1anb
50 continue
zkl=ut*h01fd
ykl=cz*zkl
eey=ykl+si*snofh
l1an07=lnafh+c3h
call TRISR
ybuoy=eey+y4
return
end
```

*

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```

et sys final/12for/scoil for##
subroutine SCOIL(nct,zt,vc0t,ct,nwt,ncc,zc,vc0c,sc,nerr)
***** implicit integer*2 (a)
***** implicit double precision (a-z)

integer*2 nct,nwt,ncc,nerr
double precision zt(25),vc0t(6),ct,ncb,zc(25),vc0c(6),sc
integer*2 illeg,ist,ncb,nwa,nwb,isol,ibrnch,uz(5)
double precision z(67),cz,cx,d,ta,lb
common /VCL0B/ illeg,ist,ncb,ncb,z,cz,cx,d,ta,lb,nwa,nwb,
& isol,ibrnch,uz
double precision za(25),zb(25)
equivalence (zt(1),za(1)),(zt(26),zb(1))
double precision ha,ala,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
& x1a,y1a,x2a,x3a,y1a,y2a,y3a,
& tana2a,tana3a,tana4a,tana5a,tana6a,la,phia
equivalence (za(1),ha),(za(2),ala),(va),
& (za(3),s1a),(za(4),w1a),(za(5),c1a),
& (za(6),s2a),(za(7),w2a),(za(8),c2a),
& (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
& (za(13),x1a),(za(14),x2a),(za(15),x3a),
& (za(16),y1a),(za(17),y2a),(za(18),y3a),
& (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
& (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phia)
double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tana2b,tana3b,tana4b,tana5b,tana6b,lb,phib
equivalence (zb(1),hb),(zb(2),alb),(vb),
& (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
& (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
& (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
& (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib)
double precision coil,slp,frct,c3,s4,w4,x4,y4,tana7,tana8,l,
& h,phih,rltot,xltot,zltot,do
equivalence (z(51),coil),(z(52),slp),(z(53),frct),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tana7),(z(60),tana8),(z(61),l),
& (z(62),h),(z(63),phih),

```

```

& (z(64),xtot),(z(65),xtot),(z(66),ztot),(z(67),do)
double precision pi ,halfpi ,degrad ,raddeg ,zero ,one ,half
integer*2 izero ,ione ,itwo
common /VCONST/ pi ,halfpi ,degrad ,raddeg ,zero ,one ,half ,
& izero ,ione ,itwo

integer*2 iscopa ,iscopb ,itana ,itanc ,ie
double precision epsy ,gamma ,se
common /VCMPO/ epsy ,gamma ,se ,iscopa ,iscopb ,itana ,itanc ,ie

double precision snphih ,cspfh ,snafh ,csafh ,tnafh ,scafh
common /VHDIR/ snphih ,cspfh ,snafh ,csafh ,tnafh ,scafh

double precision hinafh ,hw4 ,w4h ,s4w4h ,c3h
common /VHVEC/ hinafh ,hw4 ,w4h ,s4w4h ,c3h

integer*2 itan1
double precision a ,b ,snphi ,tnafh ,tnafb ,
& secphi ,secphi ,ut ,st ,ykt ,zkt ,eex ,eez ,eey ,ybuoy
common /VCSSHP/ a ,b ,snphi ,tnafh ,tnafb ,
& secphi ,secphi ,ut ,st ,ykt ,zkt ,eex ,eez ,eey ,ybuoy ,itan1

integer*2 ivs
double precision v0 ,v1 ,v2 ,f0 ,f1 ,f2 ,f ,eps
common /VSEC/ v0 ,v1 ,v2 ,f0 ,f1 ,f2 ,f ,eps ,ivs

integer*2 lh0 ,lh1 ,lh2 ,l1
double precision lh0 ,lh1 ,lh2 ,ce
common /VSCOIL/ lh0 ,lh1 ,lh2 ,ce ,lh0 ,lh1 ,lh2 ,l1
integer*2 lh(3)
double precision lh(3)
equivalence (lh ,lh0 ) ,(lh ,lh0 )

equivalence (k1e ,col1) ,(kcesq ,tanj ,gamma )
***** ****
* write(10,* ) 'SCOIL' ,ibranch ,ybuoy
f=do
ivs=0
call XSECV(nct ,zt ,vc0t ,st ,ct ,nwt ,ncc ,zc ,vc0c ,
& snafh ,csafh ,tnafh ,scafh ,4 ,nerr )
if (nerr ne 0) goto 5000

```

```
2000 continue
call X4CALC
k1e-z1(11)
eex-k1e*cspfh
eez-zk1+k1e*sphfh
kcesq=eex*eex+(zk1+eez)**2
coil=sc-dsqrt(kcesq+(yk1+yk1+kre*tnafh)**2)-lh2
tangj=z1(11an1)
ta-h*SECNT(tangj)
tb-ce
if (ibrnch eq 1) goto 2110
tb-ta
ta-ce
2110 continue
gamma=datan(tangj)+halfpi
5000 continue
return
end
*
```

```

et sys final/12for/xsecv for##
subroutine XSECV(nct,zt,vc0t,stp,ct,nwt,ncc,zc,vc0c,
& sinaf,cosaf,tanaf,secaf,iftyp,nerrf)
*****implicit integer*2 (n)
implicit double precision (a-z)

integer*2 nct,nwt,ncc,iftyp,nerrf
double precision zt(25),vc0t(6),stp,ct,zc(25),vc0c(6),
& sinaf,cosaf,tanaf,secaf

integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
double precision z(67),cz,cx,d,ta,ib
common /VGLOB/ ileg,ist,nca,ncb,z,cz,cx,d,ta,ib,nwa,nwb,
& isol,ibrnch,uz
double precision za(25),zb(25)
equivalence (z(1),za(1)),(z(26),zb(1))
double precision ha,al,a,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
& xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
& tan02a,tan03a,tan04a,tan05a,tan06a,la,phi0a
equivalence (za(1),ha),(za(2),a1a,va),
& (za(3),s1a),(za(4),w1a),(za(5),c1a),
& (za(6),s2a),(za(7),w2a),(za(8),c2a),
& (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
& (za(13),x1a),(za(14),x2a),(za(15),x3a),
& (za(16),y1a),(za(17),y2a),(za(18),y3a),
& (za(19),tan02a),(za(20),tan03a),(za(21),tan04a),
& (za(22),tan05a),(za(23),tan06a),(za(24),la),(za(25),phi0a)
double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tan02b,tan03b,tan04b,tan05b,tan06b,lb,phi0b
equivalence (zb(1),hb),(zb(2),a1b,vb),
& (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
& (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
& (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tan02b),(zb(20),tan03b),(zb(21),tan04b),
& (zb(22),tan05b),(zb(23),tan06b),(zb(24),lb),(zb(25),phi0b)
double precision col1,stp,frc1,c3,s4,w4,x4,y4,tan07,tan08,la,
& h,phi0h,rltot,xtot,ztot,do
equivalence (z(51),col1),(z(52),stp),(z(53),frc1),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),

```

```

8  (z(59),tana7),(z(60),tana8),(z(61),),
8  (z(62),h),(z(63),phih),
8  (z(64),rtot),(z(65),xitot),(z(66),ztot),(z(67),do)

double precision pi,halfpi,degrad,raddeg,zero,one,half
integer*2 izero,ione,ittwo
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,ittwo

double precision snphih,csphih,snafh,csafh,inafh,scafh
common /VHDIR/ snphih,csphih,snafh,csafh,inafh,scafh

double precision hinafh,hw4,w4h,s4w4h,c3h
common /VHVEC/ hinafh,hw4,w4h,s4w4h,c3h

integer*2 itant
double precision a,b,snphi,inafa,inafb,
& secphi,secphi,ut,st,ykt,zkt,eex,eez,eev,ybuoy
common /VCSSHP/ a,b,snphi,inafa,inafb,
& secphi,secphi,ut,st,ykt,zkt,eex,eez,eev,ybuoy,itant

integer*2 ivs
double precision v0,v1,v2,f0,f1,f2,f,eps
common /VSEC/ v0,v1,v2,f0,f1,f2,f,eps,ivs
double precision varray(3),faray(3)
equivalence (v0,varray),(f0,faray)

double precision fred
integer*2 isidr,nerra,nerrb
common /VSTAB/ fred,isidr,nerra,nerrb

integer*2 ilh0,ilh1,ilh2,il
double precision lh0,lh1,lh2,ce
common /VSCLIL/ lh0,lh1,lh2,ce,ilh0,ilh1,ilh2,il
integer*2 ilh(3)
double precision lh(3)
equivalence (ilh,ilh0),(lh,lh0)

integer*2 nerr,nit,iu,in,ivint,ndiv,rs,in

equivalence (ih,ia),(ih,anaf,ib),(ih,ent,gamma),(dv,eex),
& (vbase,eez),(fbase,eev),(absfb,rtot),(flim,xtot),(len,ztot),
& (c1ht,co1l)

```

```

equivalence (len,delv,v0sav),(ctht,delv0,vlow,v1sav),
& (delv1,vhigh,f0sav),(rat,hterm,f1sav),(ratmax,rat0),
& (is,in,ivint).
*****  

nerrf=1  

ht-z1(1)  

* write(10,*), 'XSECV', f, ht, iftyp  

htanaf=ht*ianaf  

small=1 0d-10  

eps=f*small  

if (ivs eq 0) goto 1100  

call SHIFT(0,1)  

call SHIFT(1,2)  

goto 5500  

1100 continue  

ten=1 0d1  

htenth=ht/ten  

dv=c1*I 0d-3  

n-2*nct  

do 1200 i=2,n  

if (vc01(i)) vc01(i-1) goto 1200  

j=i-1  

goto 1210  

1200 continue  

j=n  

1210 continue  

vbase=vc01(j)+htanaf  

v0=vbase  

call SUBVX(nct,z1,vc01,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
& htanaf,0,iftyp,nerr)
*****  

* if (f0 ne zero) goto 1250  

* call SHIFT(2,0)  

* nerrf=0  

* goto 6000  

*1250 continue  

*****  

fbase=f0  

absfb=dabs(fbase)  

fred=absfb  

flim=-f

```

```

if (lfotyp ne 11) flim=flim+stp
if (lfotyp eq 4) flim=flim+ykt+s4
*****
* if (lfotyp ne 21) goto 1500
* len=LENS(f,sinaf,sinaf,stp,ct/stp,ht)
* if (len gt zero) goto 1320
* ctht=ct/ht
* v0=ht*TAN1(ctht,f*ctht/stp)+ct
* goto 1350
*1320 continue
* v0=ct*(len-stp)+ht*anaf
*1350 continue
* v0=dmax1(v0,vbase)
* call SUBVX(nct,zt,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
* & htanaf,0,2,nerr)
* v1=v0+len*dv
* call SUBVX(nct,zt,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
* & htanaf,1,2,nerr)
* goto 5500
*1500 continue
***** if (fbase*flim ge zero) goto 3000
*
* write(10,*) '2'
* delv1=htenht
2100 continue
* v1=ct+htanaf+delv1
* call SUBVX(nct,zt,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
* & htanaf,1,lfotyp,nerr)
* if (f0*f1 lt zero) goto 4000
* call SHIFT(0,1)
* delv1-delv1*ten
* goto 2100
3000 continue
* write(10,*) '3'
n1=0
delv1=dv
ratmax=ct/(stp*small)
v1=vbase+delv1
goto 3150
3100 continue
rat=(v0-vbase)/(f0-fbase)

```

```

    if (dabs(rat) gt ratmax) goto 3500
    v1=vbase-fbase*rat
3150 continue
    call SUBVX(nct,zt,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
    & htanaf,l,iftyp,nerr)
    fred=dmin1(fred,dabs(f1))
    if (f0*f1 lt zero) goto 4000
    if (dabs(f1) ge absfb) goto 3500
    delv1=v1-v0
    if (n1 le 1) goto 3160
    if (dabs(one-delv*delv1/delv0**2) lt one/ten) goto 5500
3160 continue
    call SHIFT(0,1)
    delv=delv0
    delv0-delv1
    n1=n1+1
    goto 3100

3500 continue
*   write(10,*) '7'
    if (n1 eq 0 and iftyp eq 1 and nwt eq 0) goto 6000
    vlow=vbase
    hiernm=hiernth
    do 3600 ivint=1,4
    ndiv=7-ivint
    vhigh=c1*htanaf+hiern
    delv=vhigh-vlow
    n=1
    do 3550 i=1,ndiv
    v1=vlow+half*delv
    do 3540 j=1,n
    call SUBVX(nct,zt,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
    & htanaf,l,iftyp,nerr)
    if (f0*f1 lt zero) goto 4000
    fred=dmin1(fred,dabs(f1))
    v1=v1+delv
3540 continue
    n=n+n
    delv=half*delv
3550 continue
*****  

*   v1=vhigh
*   call SUBVX(nct,zt,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,

```

```

*      & h1onaf,1,iftyp,nerr)
*      if (f0*f1 lt zero) goto 1000
*      fred-dmin1(fred,dabs(f1))
***** vlow-vhigh *****
h1erm-h1erm*ten
3600 continue
goto 6000

4000 continue
*      write(10,*), '4'
n11=1
4100 continue
if (iftyp ne 4) goto 4200
if (dabs(v0-v1) gt dv or dabs(rat0) gt dv/stp) goto 4200
j=1h1-1h0
if (j*j ne 1) goto 4200
j=(3-j)/2
n=j|h(j)
f=zero
is=3*ncc
do 4120 i=1,n
f=f+zcl(is)
is=is-3
4120 continue
v0sav=v0
v1sav=v1
f0sav=f0
f1sav=f1
f0=1h0-f
f1=1h1-f
call SECVIT(nct,zt,vc0t,ncc,zc,vc0c,snafh,csafh,inafh,
& scafh,hinafh,3,nerr)
if (nerr ne 0) goto 4140
call SRISRI(ykt+zt(12),zero)
ce=h*(1onaf-zt(1,1onaf))-c3
in=2*(ncc-j)
if (ce lt vc0c(in+1) or ce gt vc0c(in)) goto 4140
nerrf=0
goto 6000
4140 continue
f=do
v0=v0sav

```

```

v1-v1sav
f0-f0sav
f1-f1sav
ih(j)=n
j=3-j
ih(j)=n+1
4200 continue
v2=half*(v0+v1)
if (n11 gt 3) v2=v1-f1*rat0
call SUBVX(nct,z1,vc01,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
& htanaf,2,iftyp,nerr)
i=1
if (f2*f0 gt zero) i=0
call SHIFT(i,2)
rat1=(v1-v0)/(f1-f0)
if (dabs(f0)+dabs(f1) lt eps*ten) goto 5500
if (n11 ge 5 and dabs(rat0/(rat0-rat1)) gt ten and
& (iftyp ne 4 or ih0 eq ih1)) goto 5500
rat0=rat1
n11=n11+1
goto 4100

5500 continue
call SECVIT(nct,z1,vc01,ncc,zc,vc0c,sinaf,cosaf,tanaf,
& secaf,htanaf,iftyp,nerrf)

6000 continue
if (fbase lt zero) fred=-fred
return
end
*
```

```

e1 sys final/12for/shift for##
      subroutine SHIFT(1,j)
*****
      implicit integer*2 ih
      implicit double precision (a-z)

      integer*2 i,j

      integer*2 ivs
      double precision v0,v1,v2,f0,f1,f2,f,eps
      common /VSEC/ v0,v1,v2,f0,f1,f2,f,eps,ivs
      double precision varray(3),farray(3)
      equivalence (v0,varray),(f0,farray)

      integer*2 lh0,ih1,lh2,il
      double precision lh0,ih1,lh2,ce
      common /VSCOLY/ lh0,ih1,lh2,ce,ih0,ih1,lh2,il
      integer*2 lh(3)
      double precision lh(3)
      equivalence (lh,ih0),(lh,ih1)

      integer*2 ix,jx
*****
      ix=i+1
      jx=j+1

      varray(ix)=varray(jx)
      farray(ix)=farray(jx)
      lh(ix)=lh(jx)
      ilh(ix)=ilh(jx)

      return
      end
*
```

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```

      ei sys final/i2for/subvx for##
      subroutine SUBVX(nct,zt,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
      & htanaf,index,iftyp,nerr)
***** implicit double precision (a-z)
      integer*2 nct,ncc,index,iftyp,nerr
      double precision zt(25),vc0t(6),zc(25),vc0c(6),sinaf,cosaf,tanaf,
      & secaf,htanaf
      double precision pi,halfpi,degrad,raddeg,zero,one,half
      integer*2 izero,ione,itwo
      common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
      & izero,ione,itwo
      double precision v0,v1,v2,f0,f1,f2,f,eps
      common /VSEC/ v0,v1,v2,f0,f1,f2,f,eps
      double precision varray(3),farray(3)
      equivalence (v0,varray),(f0,farray)

      integer*2 ih0,ih1,ih2,il
      double precision lh0,lh1,lh2,ce
      common /VSCEIL/ lh0,lh1,lh2,ce,ih0,ih1,ih2,il
      integer*2 ih(3)
      double precision lh(3)
      equivalence (ih,ih0),(lh,lh0)

      integer*2 ix
***** ix=index+1
      zt(2)=varray(ix)
      call CALC2(nct,zt,vc0t,sinaf,cosaf,tanaf,secaf,htanaf,ione,nerr)
      goto (110,120,130,130),iftyp
110 continue
      fval=zt(11)
      goto 200
120 continue
      fval=zt(12)
      goto 200
130 continue
      fval=zt(12)-zt(11)*tanaf
      lh(ix)=fval
      if (iftyp eq 3) goto 200

```

ce=WGTH(fval,incc,zc,vc0c)
call CERISR(ce,zt,fval)
11h(ix)=1
200 continue
farray(ix)=fval-f
return
end

*

```

      et sys final/i2for/wgth for##
      function WGTH(lenh,nc,z,vc0)
*****
      implicit double precision (a-z)

      integer*2 nc
      double precision wgth, lenh, z(25), vc0(6)

      double precision pi, halfpi, degrad, raddeg, zero, one, half
      integer*2 izero, one, ltwo
      common /VCONST/ pi, halfpi, degrad, raddeg, zero, one, half,
      & izero, one, ltwo

      integer*2 lh0, lh1, lh2, i1
      double precision lh0, lh1, lh2, ce
      common /VSCONST/ lh0, lh1, lh2, ce, lh0, lh1, lh2, i1
      integer*2 lh(3)
      double precision lh(3)
      equivalence (lh, lh0), (lh, lh0)

      integer*2 i, is, in
*****
      len1=zero
      is=3*nc
      in=2*nc
      do 100 i=1,nc
      len1=len1+z(is)
      if (i .lt. nc .and. lenh .gt. len1) goto 20
      wgth=vc0(in)+(lenh-len1+z(is))*z(is+1)
      i1=i
      goto 110
100 continue
      is=is-3
      in=in-2
100 continue
110 continue
      return
      end
*

```

```

et sys final/12for/cerisr for##
subroutine CERISR(ce,z1,ybb)
***** implicit double precision (a-z) *****
double precision ce,z1(25),ybb
integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(15)
double precision z(67),cz,cx,d,ta,tb
common /VCL0B/ ileg,ist,nca,ncb,z,cz,cx,d,ta,tb,nwa,nwb,
& isol,ibrnch,uz
double precision za(25),zb(25)
equivalence (z(1),za(1)),(z(26),zb(1))
double precision ha,alo,vo,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
& x1a,y1a,x1a,x2a,x3a,y1a,y2a,y3a,
& tana2a,tana3a,tana4a,tana5a,tana6a,la,phia
equivalence (za(1),ha),(za(2),alo,vo),
& (za(3),s1a),(za(4),w1a),(za(5),c1a),
& (za(6),s2a),(za(7),w2a),(za(8),c2a),
& (za(9),s3a),(za(10),w3a),(za(11),x1a),(za(12),y1a),
& (za(13),x1a),(za(14),x2a),(za(15),x3a),
& (za(16),y1a),(za(17),y2a),(za(18),y3a),
& (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
& (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phia)
double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tana2b,tana3b,tana4b,tana5b,tana6b,lb,phib
equivalence (zb(1),hb),(zb(2),alb,vb),
& (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
& (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
& (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
& (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib)
double precision co11,slp,frc1,c3,s4,w4,x4,y4,tana7,tana8,li,
& h,phih,h,r1ot,x1ot,z1ot,do
equivalence (z(51),co11),(z(52),slp),(z(53),frc1),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tana7),(z(60),tana8),(z(61),li),
& (z(62),h),(z(63),phih),
& (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)

```

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```
integer*2 i1ani
double precision a,b,snphi1,inafa,inafb,
& secphi7,secphi8,ui,st,ykt,zkt,eex,eez,eeey,ybuoy
common /VCSSHP/ a,b,snphi1,inafa,inafb,
& secphi7,secphi8,ui,st,ykt,zkt,eex,eez,eeey,ybuoy,i1ani
*****
i1ani=z1(i1ani)+cet+c3)/h
call TRISR
ybb=ykt+z1(12)+y4
return
end
*
```

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```

      PI SYS final/i2for/secv1t for##
      subroutine SECV1T(nct,z1,vc0t,ncc,zc,vc0c,
      & sinaf,cosaf,tanaf,secaf,htanaf,iftyp,ifail)
***** implicit integer*2 (#)
***** implicit double precision (a-z)

      integer*2 nct,ncc,iftyp,ifail
      double precision z1(25),vc0t(6),zc(25),vc0c(6),
      & sinaf,cosaf,tanaf,secaf,htanaf

      double precision pi,halfpi,degrad,raddeg,zero,one,half
      integer*2 izero,ione,itwo
      common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
      & izero,ione,itwo

      integer*2 ivs
      double precision v0,v1,v2,f0,f1,f2,f,eps
      common /VSEC/ v0,v1,v2,f0,f1,f2,f,eps,ivs
      double precision varray(3),farray(3)
      equivalence (v0,varray),(f0,farray)

      integer*2 nrt,nerr,nn

      equivalence (nerr,nn)
***** write(10,*1)'SECV1T',v0,f0,v1,f1,f,iftyp
      ifail=0
      nrt=1

1000 continue
      v2=v1-f1*(v1-v0)/(f1-f0)
1010 continue
      call SUBVX(nct,z1,vc0t,ncc,zc,vc0c,sinaf,cosaf,tanaf,secaf,
      & htanaf,2,iftyp,nerr)
      * write(10,*1)'CALC2',nrt,v2,f2,nerr
      if (nerr eq 0) goto 1200
      nn=nerr-nerr/3
      v2=half*(v1+vc0t(nn)+htanaf)
      goto 1010

1200 continue

```

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```
if (dabs(f2) <= eps) goto 2000
if (n11 > 50) goto 1900
call SHIFT(0,1)
call SHIFT(1,2)
n11=n11+1
goto 1000
1900 continue
if n11=1
2000 continue
return
end
*
```

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```

      er sys final/t2for/stefab for#*
      subroutine STEFAB
***** implicit integer*2 (a)
***** implicit double precision (a-z)

      integer*2  ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
      double precision z(87),cz,cx,d,ta,fb
      common /VCL0B/  ileg,ist,nca,ncb,z, cz,cx,d,ta,fb,nwa,nwb,
& isol,ibrnch,uz
      double precision za(25),zb(25)
      equivalence (z(1),za(1)),(z(26),zb(1))
      double precision ha,al0,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
& xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
& tan02a,tan03a,tan04a,tan05a,tan06a,la,phia
      equivalence (za(1),ha),(za(2),al0,va),
& (za(3),s1a),(za(4),w1a),(za(5),c1a),
& (za(6),s2a),(za(7),w2a),(za(8),c2a),
& (za(9),s3a),(za(10),w3a),(za(11),xa),(za(12),ya),
& (za(13),x1a),(za(14),x2a),(za(15),x3a),
& (za(16),y1a),(za(17),y2a),(za(18),y3a),
& (za(19),tan02a),(za(20),tan03a),(za(21),tan04a),
& (za(22),tan05a),(za(23),tan06a),(za(24),la),(za(25),ph1a)
      double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tan02b,tan03b,tan04b,tan05b,tan06b,lb,phib
      equivalence (zb(1),hb),(zb(2),alb,vb),
& (zb(3),s1b),(zb(4),w1b),(zb(5),c1b),
& (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
& (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tan02b),(zb(20),tan03b),(zb(21),tan04b),
& (zb(22),tan05b),(zb(23),tan06b),(zb(24),lb),(zb(25),phib)
      double precision co11,slp,frct,c3,s4,w4,x4,y4,tan07,tan08,l,
& h,phih,r1ot,x1ot,z1ot,do
      equivalence (z(51),co11),(z(52),slp),(z(53),frct),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tan07),(z(60),tan08),(z(61),l),
& (z(62),h),(z(63),phih),
& (z(64),r1ot),(z(65),x1ot),(z(66),z1ot),(z(67),do)
      integer*2 uz1,uz2,uz3,uz4,uz5
      equivalence (uz(1),uz1),(uz(2),uz2),(uz(3),uz3),(uz(4),uz4),

```

```

& (uz(5),uz5)

double precision pi,halfpi,degrad,raddeg,zero,one,half
integer*2 izero,ione,itype
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,itype

double precision delyk,twod,halfd,dsg
common /VANCH/ delyk,twod,halfd,dsg

double precision snphih,cspfh,snfh,csfh,inafh,scfh,dsnph
common /VDIR/ snphih,cspfh,snfh,csfh,inafh,scfh,dsnph

double precision epsy,gamma,se
integer*2 ia,ib,ie
common /VCMPD/ epsy,gamma,se,ia,ib,ie

double precision sa,sb,ca,cb,vc0a(6),vc0b(6),
& eex0,eez0,eey0,a0,b0,phi0,phi0
integer*2 icase
common /VSPID/ sa,sb,ca,cb,vc0a,vc0b,
& eex0,eez0,eey0,a0,b0,phi0,phi0,
& icase

double precision a,b,snph1,inafa,inafb,
& sec07,sec08,ut,st,ykt,zkt,eex,eez,eey,ybuoy
common /VCSSHP/ a,b,snph1,inafa,inafb,
& sec07,sec08,ut,st,ykt,zkt,eex,eez,eey,ybuoy

integer*2 ivs
double precision v0,v1,v2,f0,f1,f2,f,eps
common /VSEC/ v0,v1,v2,f0,f1,f2,f,eps,ivs

double precision xred
integer*2 isidf,nerra,nerrb
common /VSTAB/ xred,isidf,nerra,nerrb

integer*2 nif,ipoint,ifail,ivsq,iswi

double precision jac(2,2)
equivalence (jac(1,1),j11),(jac(1,2),j12),(jac(2,1),j21),
& (jac(2,2),j22)

```

```

double precision zz(7)
 equivalence
& (zz(1),asav,delamx,delanw,anew),
& (zz(2),aold,delo,chnge,aedge),
& (zz(3),bold,delb,chngb,bnedge),(zz(4),y1,dcoeff),(zz(5),y2),
& (zz(6),ysqo,y1x,aedge),(zz(7),y2x,bedge)
 double precision delx(2)
 equivalence (delo,delx)

 equivalence (cosmx,scafz,halfdd,s1,bsav,delmx,delbm,delbnw,bnew),
& (csphn,hddcsp,xmid,temp1,ysqsv,del),(temp,fact,rat)

 function (arga,argb,argd)-arga*arga+dsq-argb*argb+argd*(snphi+h+snphi-h)
 & *arga
 *****
 * Set constant terms
 *****
 epsysq-epsy*epsy
 zp9=0.9d0

 *****
 * Set iteration switch for subroutine XECV to zero
 *****
 lvs=0

 *****
 * Compute upper bounds for a,b, they might not be least upper bounds
 *****
 amx-one
 bmx-one
 if (lnafh le zero) goto 120
 cosmx=dmax1(csaft,one/SECNT(cz))
 if (cz lt zero) amx-cosmx
 if (cz gt zero) bmx-cosmx
 120 continue
 amx=amx*sa
 bmx=bmx*sb

 *****
 * Compute initial guess for (a,b) and assign to anew,bnew
 * Set (a,b) equal to nearest asymptotic point
 *****
 scafz=SECNT(cz)

```

```

csphin=csafh*(snphi*h+cz*inafh)/scafz
halfdd=halfd*scafz
hddcsp=halfdd*csphin
temp=hddcsp*hddcsp-halfdd*halfdd
s1=dmin1(dsqr1(sat+temp)+hddcsp,dsqr1(sb*sb+temp)-hddcsp)
do 300 i=1,7
zz(i)=z(i)
300 continue
ha-h
s1a-s1
w1a=(catcb)/s1
c1a=c3
s2a=s4
w2a=w4
call VCRIT0(i,za,vc0a)

f=do
call XSECV(2,za,vc0a,s1a+s2a,vc0a(1),nwa,ncb,zb,vc0b,
& snafh,csafh,inafh,scafh,2,i fail)

xm1d=z(1)
temp=xm1d*xm1d+halfd*halfd
temp1=xm1d+dsnph
anew=dsqr1(temp-temp1)
bnew=dsqr1(temp+temp1)
a=half*(anew+bnew-dsnph)
b=a+dsnph

do 500 i=1,7
z(i)=zz(i)
500 continue
call VCRIT0(ncb,za,vc0a)

*****
* Beginning of code for Steffensen iteration
*****
* Test new point (a,b) for validity via subroutine CALC3 and adjust
* if necessary, while generating error vector (y1,y2)
* Point (a,b) lies within hyperbolic region, but value of a or b
* may be too large. Point (aold,bold) has passed test with CALC3
*****
n1=0

```

```

    lysq=0
1000 continue
*   write(10,*)
*   write(10,*) 'ITER',n1
  lsw1=0
1010 continue
  lswdf=1
  call CALC3(a,b,y1,y2)
  ysq=y1*y1+y2*y2
  if (inerr+inerrb eq 0 and (n1 eq 0 or lsw1 eq 1
  & or ysq lt ysq0*1.1d0)) goto 1200
  if (n1 eq 0 or lsw1 eq 1) goto 1100
  a=half*(a+aold)
  b=half*(b+bold)
  goto 1010
1100 continue
  temp=dmax1(xred+xred, half*(halfd*(one-snph*h)-a))
  a=a+temp
  b=b+temp
  goto 1010
1200 continue
  if (n1 eq 0) goto 2400
  if (lsw1 eq 0 or ysq lt ysqav) goto 1250
  a=a*av
  b=b*av
  ysq=ysqav
  lsw1=0
  goto 1300
1250 continue
  if (lsw1 eq 0 and ysq ge zp9*ysq0) lysq=lysq+1
1300 continue
  if (lysq le 4) goto 1400
  asov=a
  bsov=b
  ysqav=ysq
  a=half*(a+b-dsnph)
  b=a+dsnph
  lsw1=1
  lysq=0
  goto 1010

```

```
*****
* Finished if error vector is sufficiently small or current test point
* is sufficiently close to previous test point
*****
1400 continue
  if (ysq .lt. epsysq) goto 5000
  if (ysq .lt. epsysq*1.0d8 and
    & dabs(one-a/aold)+dabs(one-b/bold) .lt. 1.0d-8) goto 5000

*****
* Compute deltas for Jacobian matrix estimate
*****
  if (n1t .eq. 1 or nswl .eq. 1) goto 1500
  dela=(j11*y1+j12*y2)*dsqr((j21*j21+j22*j22)/detj)
  delb=(j21*y1+j22*y2)*dsqr((j11*j11+j12*j12)/detj)
  goto 2000
1500 continue
  dela=dsqr(half*ysq)
  delb=dela

*****
* Adjust deltas as necessary
*****
2000 continue
*  write(10,*), 'init del', dela, delb
  rat=dmax1(one,epsy/dabs(dela),epsy/dabs(delb))
  dela=rat*dela
  delb=rat*delb
  delmx=dmin1(dabs(a-b+d),dabs(b-a+d),a+b-d)
  delamx=dmin1(amx-a,delmx)
  delbmx=dmin1(bmx-b,delmx)
  rat=dmini(one,delamx/dabs(dela),delbmx/dabs(delb))
  if (rat .ne. one) rat=1.0d0*rat
  dela=dela*rat
  delb=delb*rat

2005 continue
  delanw=dela
  if (fun1(a+delanw,b,d) .gt. zero) goto 2110
  call EDCPT(a,b,a+delanw,b,d,aedge,bedge)
  delanw=aedge-a
2110 continue
  if (fun1(b,a+delanw,-d) .gt. zero) goto 2120
```

```

call EDGPT(b,a,b,a+delanw,-d,bedge,aedge)
delanw-aedge-a
2120 continue
delbnw-delb
if (fun1(a,b+delbnw,d) gt zero) goto 2130
call EDGPT(a,b,a,b+delbnw,d,aedge,bedge)
delbnw-bedge-b
2130 continue
if (fun1(b+delbnw,a,-d) gt zero) goto 2140
call EDGPT(b,a,b+delbnw,a,-d,bedge,aedge)
delbnw-bedge-b
2140 continue

rat-one
if (dela eq delanw and delb eq delbnw) goto 2160
rat-dmin1(dabs(delanw/dela),dabs(delbnw/delb))*0 1d0
2160 continue
dela=rat*dela
delb=rat*delb
* write(10,*) 'fin del',dela,delb,rat
* if (fun1(a+dela,b,d) gt zero and fun1(b,a+dela,-d) gt zero
* & and fun1(a,b+delb,d) gt zero and fun1(b+delb,a,-d) gt zero)
* & goto 2190
* dela-half*dela
* delb-half*delb
* goto 2005
*2190 continue

*****
* Estimate Jacobian matrix
*****
2200 continue
ipoint-1
2205 continue
del=delx(ipoint)
isidf-1
if (del lt zero) isidf-2
if (ipoint eq 2) isidf-3-isidf
call CALC3(a+(2-ipoint)*dela,b+(ipoint-1)*delb,y1x,y2x)
if (nerra+nerrb eq zero) goto 2220
dela-half*dela
delb-half*delb

```

```

      goto 2200
2200 continue
  jac(1,ipoint)=(y1x-y1)/del
  jac(2,ipoint)=(y2x-y2)/del
  ipoint=ipoint+1
  if (ipoint le 2) goto 2205
*   write(10,*), 'Jac', j11,j12
*   write(10,*), ' ', j21,j22
*****
* Invert Jacobian matrix and compute new point (anew,bnew)
*****
detj=j11*j22-j12*j21
temp=j11
j11=j22/detj
j22=temp/detj
j12=-j12/detj
j21=-j21/detj
anew=a-(j11*y1+j12*y2)
bnew=b-(j21*y1+j22*y2)
*   write(10,*), 'inv', j11,j12
*   write(10,*), ' ', j21,j22
*****
* Adjust new point (anew,bnew) as necessary
*****
2400 continue
*   write(10,*), 'init new pt', anew,bnew
fact=one
if (dabs(anew-bnew) lt d) goto 2500
fact=zpg
dcoeff=d
if (anew gt bnew) dcoeff=-d
chnga=anew-a
chngb=bnew-b
anew=(chnga*(b-dcoeff)-chngb*a)/(chnga-chngb)
bnew=anew+dcoeff
2500 continue
*   write(10,*), anew,bnew
if (anew+bnew gt d) goto 2600
fact=zpg
chnga=anew-a
chngb=bnew-b

```

```

        anew=(chnga*(d-b)+chngb*a)/(chnga+chngb)
        bnew=d-anew
2600    continue
*      write(10,*), anew,bnew
*      if (funl(anew,bnew,d) gt zero) goto 2800
*      fact=zpg
*      call EDCPT(a,b,anew,bnew,d,anedge,bnedge)
*      anew=anedge
*      bnew=bnedge
2800    continue
*      write(10,*), anew,bnew
*      if (funl(bnew,anew,-d) gt zero) goto 2900
*      fact=zpg
*      call EDCPT(b,a,bnew,anew,-d,bnedge,anedge)
*      anew=anedge
*      bnew=bnedge
2900    continue
*      write(10,*), anew,bnew
*      anew=a+fact*(anew-a)
*      bnew=b+fact*(bnew-b)
*      write(10,*), 'fin new pt ', anew,bnew,fact
*      if (funl(anew,bnew,d) gt zero and funl(bnew,anew,-d) gt zero)
*      & goto 3000
*      anew=half*(a+anew)
*      bnew=half*(b+bnew)
*      goto 2600
*3000    continue
***** Shift values and return to beginning of Steffensen iteration *****
* Shift values and return to beginning of Steffensen iteration
***** Shift values and return to beginning of Steffensen iteration *****
old=a
bold=b
ysqo=ysq
a=anew
b=bnew
n1=n1+1
goto 1000

5000    continue
      return
      end

```

```

et sys final/12for/calc3 for##
subroutine CALC3(a,b,y1,y2)
***** implicit integer*2 (#)
***** implicit double precision (a-z)

double precision a,b,y1,y2

integer*2 ileg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(5)
double precision z(67),cz,cx,d,ta,tb
common /VGLOB/ ileg,ist,nca,ncb,z,ez,cx,d,ta,tb,nwa,nwb,
& isol,ibrnch,uz
double precision za(25),zb(25)
equivalence (z(1),za(1)),(z(26),zb(1))
double precision ha,al0,va,s1a,w1a,cl0,s2a,w2a,c2a,s3a,w3a,
& x0,y0,x1a,x2a,x3a,y1a,y2a,y3a,
& tan02a,tan03a,tan04a,tan05a,tan06a,la,phi0
equivalence (za(1),ha),(za(2),al0,va),
& (za(3),s1a),(za(4),w1a),(za(5),cl0),
& (za(6),s2a),(za(7),w2a),(za(8),c2a),
& (za(9),s3a),(za(10),w3a),(za(11),x0),(za(12),y0),
& (za(13),x1a),(za(14),x2a),(za(15),x3a),
& (za(16),y1a),(za(17),y2a),(za(18),y3a),
& (za(19),tan02a),(za(20),tan03a),(za(21),tan04a),
& (za(22),tan05a),(za(23),tan06a),(za(24),la),(za(25),phi0)
double precision hb,alb,vb,s1b,w1b,clb,s2b,w2b,c2b,s3b,w3b,
& xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
& tan02b,tan03b,tan04b,tan05b,tan06b,lb,phi0
equivalence (zb(1),hb),(zb(2),alb,vb),
& (zb(3),s1b),(zb(4),w1b),(zb(5),clb),
& (zb(6),s2b),(zb(7),w2b),(zb(8),c2b),
& (zb(9),s3b),(zb(10),w3b),(zb(11),xb),(zb(12),yb),
& (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
& (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
& (zb(19),tan02b),(zb(20),tan03b),(zb(21),tan04b),
& (zb(22),tan05b),(zb(23),tan06b),(zb(24),lb),(zb(25),phi0)
double precision co1,slp,frct,c3,s4,w4,x4,y4,tan07,tan08,l,
& h,phi0,r10t,x10t,z10t,do
equivalence (z(51),co1),(z(52),slp),(z(53),frct),(z(54),c3),
& (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
& (z(59),tan07),(z(60),tan08),(z(61),l),
& (z(62),h),(z(63),phi0),
& (z(64),r10t),(z(65),x10t),(z(66),z10t),(z(67),do)

```

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```
double precision pi ,halfpi ,degrad ,raddeg ,zero ,one ,half
integer*2 izero ,ione ,itwo
common /VCONST/ pi ,halfpi ,degrad ,raddeg ,zero ,one ,half ,
& izero ,ione ,itwo

double precision delyk ,twod ,halfd ,dsq
common /VANCH/ delyk ,twod ,halfd ,dsq

double precision sa ,sb ,ca ,cb ,vc0a(6) ,vc0b(6) ,
& eex0 ,eez0 ,eey0 ,a0 ,b0 ,phi0a0 ,phi0b0
integer*2 icode
common /VSPID/ sa ,sb ,ca ,cb ,vc0a ,vc0b ,
& eex0 ,eez0 ,eey0 ,a0 ,b0 ,phi0a0 ,phi0b0 ,
& icode

integer*2 iscopa ,iscopb ,itana ,itanb ,ie
double precision epsy ,gamma ,se
common /VCMPD/ epsy ,gamma ,se ,iscop0 ,iscopb ,itana ,itanb ,ie

double precision qa ,qb ,snphi ,tnphi ,tnfb ,
& sec07 ,sec08 ,ut ,st ,ykt ,zkt ,eex ,eez ,eey ,ybuoy
common /VCSHPP/ qa ,qb ,snphi ,tnphi ,tnfb ,
& sec07 ,sec08 ,ut ,st ,ykt ,zkt ,eex ,eez ,eey ,ybuoy

double precision v0 ,v1 ,v2 ,f0 ,f1 ,f2 ,f ,eps
common /VSEC/ v0 ,v1 ,v2 ,f0 ,f1 ,f2 ,f ,eps

double precision xred
integer*2 isid ,nerra ,nerrb
common /VSTAB/ xred ,isid ,nerra ,nerrb

integer*2 nsid

equivalence (sca ,scb ,itana7)
*****  
* write(10,*1)'CALC3',a,b  
nerra=0  
nerrb=0  
call PHIBA(a,b,a*a-b*b,dsq,twod,phi0a,phi0b)  
call HSPLIT  
if (ha .gt. zero and hb .gt. zero) goto 900  
nerra=1
```

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```

nerrb=1
goto 5000
900 continue
nsid=1
1000 continue
goto (1100,1200),isidf
1100 continue
sca-SECT1(inafa)
f=a
call XSECV(nca,za,vc0a,sa,ca,nwa,incb,zb,vc0b,
& inafa/sca,one/sca,inafa,sca,1,nerra)
if (nerra eq 0) goto 2000
goto 5000
1200 continue
scb-SECT1(inafb)
f=b
call XSECV(ncb,zb,vc0b,sb,cb,nwb,nca,za,vc0a,
& inafb/scb,one/scb,inafb,scb,1,nerrb)
if (nerrb eq 0) goto 2000
goto 5000
2000 continue
if (nsid eq 2) goto 2200
nsid=2
isidf+3-isidf
goto 1000
2200 continue
tan07=(c3+h0*z0(1+tan0)+hb*zb(1+tanb))/h
call TRISR
y1=half*(ya+yb)+y4-do
y2=yb-ya-delyk
call X4CALC
5000 continue
* write(10,*), 'END CALC3',nerra,nerrb,y1,y2
* write(10,*), va,ya,vb,yb
* write(10,*)
return
end
*
```

```

et sys final/12for/edgpt for#
 subroutine EDGPT(a,b,aa,bb,d,x,y)
 ****
 implicit double precision (a-z)

 double precision a,b,aa,bb,d,x,y

 integer#2 illeg,ist,nca,ncb,nwa,nwb,isol,ibrnch,uz(15)
 double precision z(67),cz,cx,qd,ta,lb
 common /VGLOB/ illeg,ist,nca,ncb,z,cz,cx,qd,ta,lb,nwa,nwb,
 & isol,ibrnch,uz
 double precision za(25),zb(25)
 equivalence (z(1),za(1)),(z(26),zb(1))
 double precision ha,alb,va,s1a,w1a,c1a,s2a,w2a,c2a,s3a,w3a,
 & xa,ya,x1a,x2a,x3a,y1a,y2a,y3a,
 & tana2a,tana3a,tana4a,tana5a,tana6a,la,phia
 equivalence (za(1),ha),(za(2),alb),(za(3),va),
 & (za(4),s1a),(za(5),w1a),(za(6),c1a),
 & (za(7),s2a),(za(8),w2a),(za(9),c2a),
 & (za(10),s3a),(za(11),w3a),(za(12),y1a),
 & (za(13),x1a),(za(14),x2a),(za(15),x3a),
 & (za(16),y1a),(za(17),y2a),(za(18),y3a),
 & (za(19),tana2a),(za(20),tana3a),(za(21),tana4a),
 & (za(22),tana5a),(za(23),tana6a),(za(24),la),(za(25),phia)
 double precision hb,alb,vb,s1b,w1b,c1b,s2b,w2b,c2b,s3b,w3b,
 & xb,yb,x1b,x2b,x3b,y1b,y2b,y3b,
 & tana2b,tana3b,tana4b,tana5b,tana6b,lb,phib
 equivalence (zb(1),hb),(zb(2),alb),(zb(3),vb),
 & (zb(4),s1b),(zb(5),w1b),(zb(6),c1b),
 & (zb(7),s2b),(zb(8),w2b),(zb(9),c2b),
 & (zb(10),s3b),(zb(11),w3b),(zb(12),yb),
 & (zb(13),x1b),(zb(14),x2b),(zb(15),x3b),
 & (zb(16),y1b),(zb(17),y2b),(zb(18),y3b),
 & (zb(19),tana2b),(zb(20),tana3b),(zb(21),tana4b),
 & (zb(22),tana5b),(zb(23),tana6b),(zb(24),lb),(zb(25),phib)
 double precision co1,slp,frc1,c3,s4,w4,x4,y4,tan07,tan08,1,
 & h,phih,r101,x101,z101,do
 equivalence (z(51),co1),(z(52),slp),(z(53),frc1),(z(54),c3),
 & (z(55),s4),(z(56),w4),(z(57),x4),(z(58),y4),
 & (z(59),tan07),(z(60),tan08),(z(61),1),
 & (z(62),h),(z(63),phih),
 & (z(64),r101),(z(65),x101),(z(66),z101),(z(67),do)

```

```

double precision pi,halfpi,degrad,raddeg,zero,one,half
integer*2 izero,ione,ltwo
common /VCONST/ pi,halfpi,degrad,raddeg,zero,one,half,
& izero,ione,ltwo

double precision delyk,twod,halfd,dsq
common /VANCH/ delyk,twod,halfd,dsq

double precision snphih,csphih,snafh,csafh,inafh,scafh
common /VDIR/ snphih,csphih,snafh,csafh,inafh,scafh

integer*2 iscopa,iscopb,ilana,iltanb,ie
double precision epsy,gamma,se
common /VCMPD/ epsy,gamma,se,iscopa,iscopb,ilana,iltanb,ie

integer*2 itant
double precision qa,qb,snphi,inaph,inafb,
& secphi7,secphi8,ut,st,ykt,zkt,eex,eez,eyy,ybuoy
common /VCSHP/ qa,qb,snphi,inaph,inafb,
& secphi7,secphi8,ut,st,ykt,zkt,eex,eez,eyy,ybuoy,itant

equivalence (dela,aa),(delb,root1,bb),(delasq,coeff2,temp,gamma),
& (cp,coeff1,eex),(coeff0,discr,eez),(slope,eyy),(dsnph,root)
*****dsnph=d*snphi
if (a ne aa) goto 100
x=a
y=dsqr((a*(a+dsnph+dsnph)+dsq))
goto 1000
100 continue
dela=aa-a
delasq=dela*dela
delb=bb-b
cp=a*bb-aa*b
coeff0=dsq*delasq-cp*cp
coeff1=cp*delb+dsnph*delasq
slope=delb/dela
if (dabs(one-dabs(slope)) gt 1.0d-6) goto 200
x=-coeff0/(coeff1+coeff1)
goto 500
200 continue
coeff2=delasq-delb*delb
discr=dsqr((coeff1*coeff1-coeff2*coeff0))

```

```
root1=(-coeff1-discrim)/coeff2
x=(-coeff1+discrim)/coeff2
if (root1 <= x) goto 220
temp=x
x=root1
root1=temp
220 continue
if ((a != aa and root1 >= a) or (aa != a and x >= a))
& x=root1
500 continue
if ((x-a)*(x-aa) ge zero) x=aa
y=b+(x-a)*slope
1000 continue
return
end
*
```

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